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HERBAGE PRODUCTION AND CARRYING CAPACITY OF BITTERBRUSH[1/]

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Bitterbrush is one of the most important browse species for deer throughout the western United States. It is highly palatable and nutritious (Smith and Hubbard, 1954; Smith, 1952; Bissell, et al., 1955), and it grows naturally on many winter deer ranges where palatable and nutritious herbage is inadequate for most deer herds.

For these reasons, considerable emphasis has been placed on bitterbrush management and its artificial propagation. Very few studies have been conducted to determine the quantity of usable herbage produced by bitterbrush. This type of information is needed to determine how much effort and money can be spent to keep bitterbrush on a range or to reestablish it through artificial means. Since it is difficult to express the value of deer herbage in dollars and cents, this paper will evaluate bitterbrush in terms of the amount of deer browse produced.

Determination of Total Production

Plants were collected in December, 1957, from the Doyle winter deer range in Lassen County, California. This area, administered by the California Department of Fish and Game, was fenced against livestock for 6 years before collection of the plants. The only grazing

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on the area during these 6 years was by trespass cattle and deer. Actually, the area is somewhat lower in elevation than the most heavily used deer range in this region. None of the plants collected showed any sign of current grazing at the time of collection. No site differences were observed between the points of collection of the various plants.

All current leaders were removed from five mature bitterbrush plants. In addition, all spur or bud material was removed from three of the plants. Some shattered leaves in the collection could not be assigned to either the spurs or leaders, so this material was considered as a separate type of herbage--although, of course, it isn't. All herbage was air dried and weighed.

Production in Relation to Plant Size and Age

Each plant was aged by ring counts. Age and size of plant were directly related. The youngest plant, 28 years old was also smallest. The largest one was the oldest, 93 years (fig. 1).

There was no direct relationship between weight of leaders produced and either size or age. The plant intermediate in both size and age produced the greatest weight of leaders. The weight of leaders on the largest plant was less than one half that on the smallest plant.

Of the three plants from which spurs were removed, the largest plant produced the greatest total weight of herbage (leaders, spurs, and shattered leaves). However, even this relationship was not in direct proportion to size. The youngest plant was 45 inches tall and had an average diameter of 53 inches. The oldest plant was 87 inches tall and had an average diameter of 57 inches. The smaller plant--only about half the height of the larger--produced a total of 570 grams of herbage; the larger, only 662 grams.

The largest plant probably had enough photosynthetic material to maintain itself for many more years. However, the primary source of deer food is the leaders, and they made up only about one-fifth of this plant's total browseable herbage. This suggests that older plants, obviously lacking in vigor, should be replaced by younger, more vigorous plants. Condition and vigor play at least as important a part in production as does size.

Weight Distribution Along Leaders

It was necessary to determine the weight distribution along leaders in order to convert from total herbage weight to usable weight. To assure that all plants and all leader lengths were considered, the leaders on each plant were separated into 2.5 centimeter length classes. The greatest number of leaders fell into the

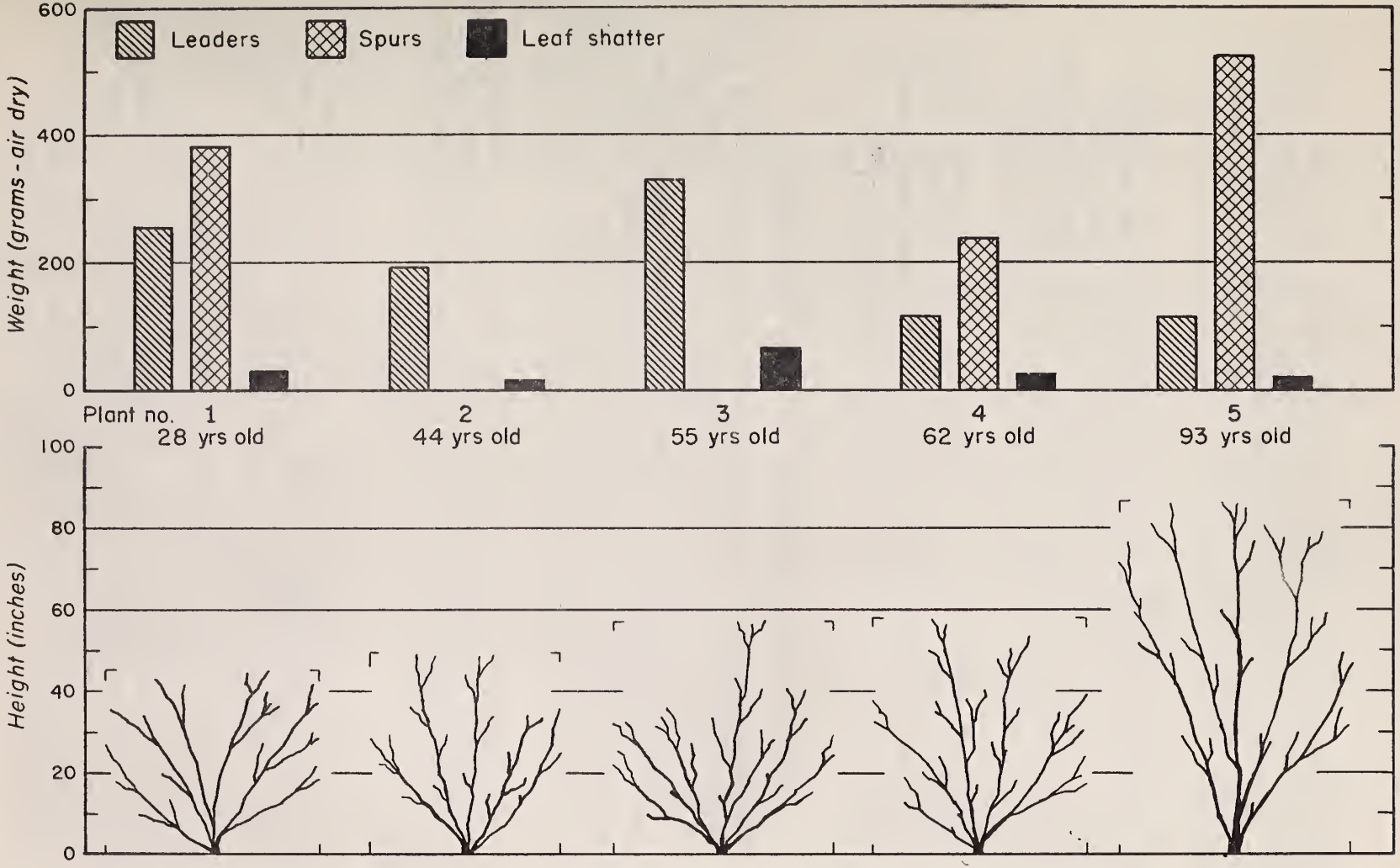

Figure 1.--Diagrammatic representation of the size and age of the 5 bitterbrush plants studied and the weight of herbage produced by each.

5 classes between 5.0 and 17.5 cm (Hubbard, 1958). For each of the 5 plants, a sample of 20 leaders was randomly drawn from each of the classes included in the above range, making a total of 100 leaders in each length class. Outside of this range, less than 100 leaders were available, so all were used.

Each leader less than 10.0 cm. in length was cut into 1.0 cm. sections and those more than 10.0 cm. long into 2.0 cm. sections. All comparable sections were grouped for each 2.5 length class. These sections were air dried and weighed, and the cumulative length and weight percentages computed. Data from all classes were then averaged and a weight distribution curve was constructed (fig. 2).

This curve shows that if a given percentage of leader length is removed, the weight removed amounts to a lower percentage of the total. For example, 60 percent utilization of leader length results in the removal of only about 47 percent of the herbage weight. This is due, of course, to the taper of leaders from butt to tip.

Herbage Production Related to Deer Requirements

The maximum amount of herbage which can be removed from a plant without damage (proper use) undoubtedly varies with the age and condition of the plant, its past history, the site on which it is growing, and perhaps other factors. Hormay (1943) found proper use on bitterbrush to be 60 percent utilization of leader length on one site in northeastern California. Assuming that this figure holds true for the study plants, it would be possible to remove 120.3, 89.3, 154.6, 54.5, and 55.0 grams of leaders air dry without harming the plants.

A 100-pound deer needs about 1,067 grams of air-dry herbage to maintain itself for one day (Nichol, 1938). Assuming that this deer eats a pure diet of bitterbrush, it would take 587 of the lowest producing plants and 207 of the highest producers to maintain it for one month.

The area from which these plants came has an average stocking of only about 28 bitterbrush plants per acre. Even if all of the plants produced as much as the highest producer, an acre would provide only a little more than 0.1 deer month of grazing (fig. 3).

In contrast to this low plant stocking, a reseeded acre in the same area is stocked with 850 4-year old bitterbrush plants. These plants are growing vigorously, and there is no indication that the area is overstocked. An acre of this bitterbrush range would support a 100-pound deer for more than a month even if the plants were producing only as much herbage as the poorest producer of the study plants.

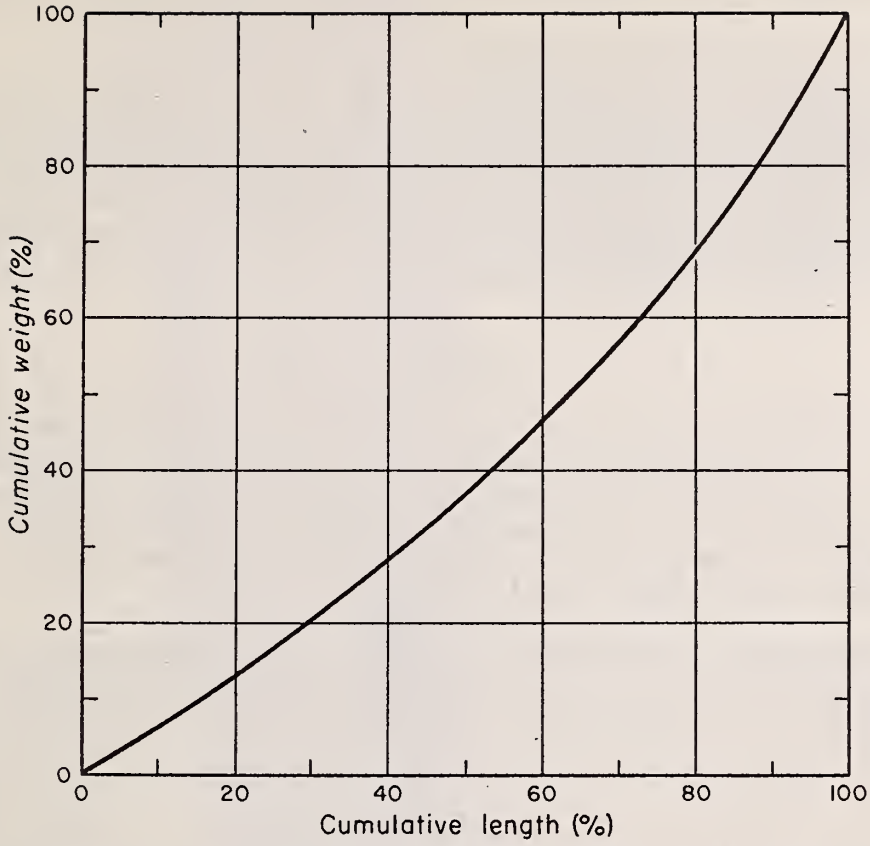

Figure 2.--Relationship of percentage of weight to percentage of bitterbrush leader length.

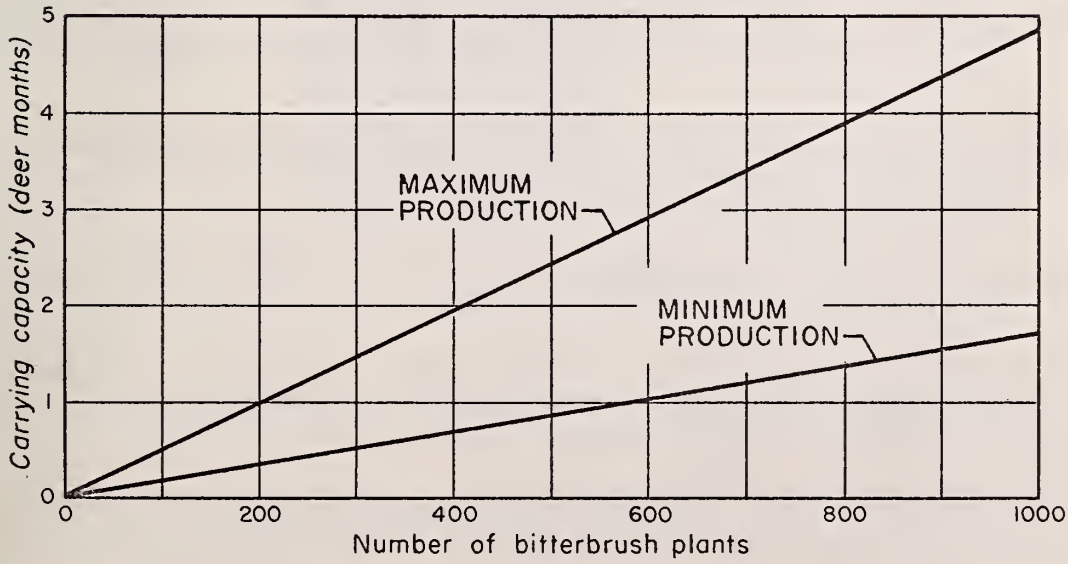

Figure 3.--Bitterbrush carrying capacity for a 100 pound deer in terms of number of plants.

Other experimental plantings in northeastern California are stocked with as many as 8,000 3-year-old plants per acre. Guides for proper stocking of bitterbrush are not available as yet. The desirable rate undoubtedly varies from site to site. However, 8,000 plants per acre is probably too dense a stand for good production on individual plants.

Summary

Total herbage production was determined for five mature bitterbrush plants collected in northeastern California. The distribution of weight along the leader was studied to provide a basis for converting from percentage of leader length removed to percentage of weight removed. Proper use was assumed to be 60 percent of the leader length or 49 percent of the weight.

Assuming that a 100-pound deer eats a pure diet of bitterbrush, it would take 587 of the poorest producing plants and 207 of the highest producers to maintain him for one month.

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